Keynote Address: COAL USAGE IN THE MALAYSIAN POWER SECTOR – OPPORTUNITIES AND CHALLENGES

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1.0 INTRODUCTION

Coal utilization for power generation in Malaysia started in 1988 when the 2x300 MW coal fired units at Stesen Janaelektrik Sultan Salahuddin Abdul Aziz (SJSSAA), Kapar was commissioned. Since then, the station had been consuming coal at about 1.5 million-ton per annum (mtpa) until last year when another 2x500MW coal fired units were fully commissioned. With the additional units the annual consumption of SJSSAA, Kapar is expected to be about 4.5 mtpa.

The development of coal utilization had been slow since the first generation Independent Power Producers (IPPs) were more inclined to building combine cycle gas turbine plant. As a result, the generation mix was highly dependent on gas, which can be a disadvantage to the grid system resilience and reliability. The present generation mix is 79.2 % gas, 10.3 % coal, 7% hydro and 3.5 % oil. The five-fuel policy as prescribed by the Government has to be enhanced to improve the Grid System resilience and reliability, by moving away from the high dependence on gas to the increased utilization of other fuels, especially coal and hydropower. It is expected that coal generation will increase at a higher rate than gas generation. According to the present planting up program, by the year 2010, coal consumption in power industry in Malaysia may reach 19 mtpa.

This Paper attempts to highlight some of the challenges, issues and opportunities following the increase in coal utilization in the Malaysian Power Sector. A broad overview will be given and it is hoped that the details will be discussed by other speakers over the next two days.

2.0 EXISTING INSTALLED GENERATION CAPACITY

TABLE 1 - TOTAL INSTALLED CAPACITY (MW) IN 2000, PENINSULAR MALAYSIA

Type	Fuel	Capacity (MW)	Percentage (%)
Conventional Thermal	Coal	600	5.00
Conventional Thermal	Oil/Gas	1,751	14.60
Combine Cycle	Gas	1,557	12.98
Gas Turbine	Gas	1,728	14.41
Hydro	-	1,873.5	15.62
Diesel	Diesel	10	0.09
Total TNB		7,519.5	62.70
Total IPPs	Gas	4,474	37.30
Total Installed Capacity		11,993.5	100

3.0 DEVELOPMENT OF COAL FIRED POWER PLANT

Coal fired generation capacity will grow faster than gas fired generation capacity over the next ten years. Table 2 identifies the existing and planned coal fired generation over the next ten years. Coal utilization will see a consumption growth from about 3.5 mtpa today to about 19 mtpa in 2007.

TABLE 2 - EXISTING AND PLANNED COAL-FIRED POWER PLANT 2000 - 2010

Existing and Planned Coal-Fired Power Plant 2000 - 2010			
Plant	Capacity	Completion	Coal Utilization
TNB Kapar Ph. 2	600 MW	1988	1.5 mtpa
TNB Kapar Ph. 3	1000 MW	2001	2.5 mtpa
TNB Janamanjung	2100 MW	2002/03	6.0 mtpa
SKS - IPP	2100 MW	2005/06	5.7 mtpa
Jimah - IPP	1400 MW	2005/06	3.5 mtpa
Total	7200 MW		19.2 mtpa

4.0 PROJECTED COAL DEMAND

By year 2010, coal fired IPPs inclusive of TNB owned IPPs in Peninsular Malaysia will be utilizing up to 19 mtpa at an annual cost of approximately USD 760 million. The expected coal utilization for the electricity industry until year 2010 is listed below.

TABLE 3 - COAL UTILIZATION 2001-2010

Coal Utilization 2001-2010			
Year	2001	2003	2007
Coal Fired Capacity (MW)	1600	3700	7200
Annual Coal Consumption (Million MT)	4	9	19.2
Annual Coal Cost @ USD 40.00 CIF (USD million)	160	360	770
Power Plant Generating Units	4	7	12
Discharge Ports	1	2	4

TABLE 4 - PROJECTED COAL DEMAND 2002 – 2010 (TONNE)

	Kapar	TNBJ	SKS	Jimah	Total Demand
2002	4,000,000	1,560,000	-		5,556,000
2003	4,000,000	5,170,000	-		9,170,000
2004	4,000,000	6,000,000	-		10,000,000
2005	4,000,000	6,000,000	1,900,000		11,900,000
2006	4,000,000	6,000,000	5,000,000	875,000	15,875,000
2007	4,000,000	6,000,000	5,700,000	3,500,000	19,200,000

5.0 CHALLENGES AND ISSUES

5.1 Environmental Impact

Protection of the environment is without question a high profile issue. The public and local communities in Malaysia are becoming increasingly aware of the environmental issues, and the need for environmental protection and conservation. Environmental impacts of coal may be viewed as stemming from either the consumption of coal, the discharge of pollutants or from the disposal of ash.

Better plant efficiency will reduce coal consumption per unit of electricity generated and correspondingly will reduce discharge of pollutants and production of ash. Therefore, there is a need to seriously examine how existing plant efficiency could be improved and how new technologies can be applied in the design of new and more efficient plant.

For example it was reported some years back that Pacific Power achieved 0.49 % efficiency improvement of a 500 MW turbo-alternator set by replacing three rows of turbine blades which were susceptible to blade erosion and cracking. Two of these rows were replaced with updated blades, which incorporated design refinements and improved manufacturing processes. The third row was replaced with blades of a high twist design. The overall program covering two 500 MW units cost USD 14.9 million and yielded NPV benefits estimated at USD 34.6 million. In environmental terms, the efficiency improvements led to significant reduction in coal consumption, which reduced the greenhouse gas emission, SO_X, NO_X and particulate emissions.

As for future plant up, local power plant developers should closely kept abreast with the development of advanced clean coal technologies such as pressurized fluidized bed combustion (PFBC), and integrated gasification combined cycle (IGCC). A matter of concern to developers and financiers is of course project profitability and viability. Unless and until these new technologies are proven economical and reliable, there will always be apprehension and doubt on their practical application. Researchers, designers and manufacturers of these new design plants therefore need to coordinate their effort to convince plant developers and financiers of the positive attributes of their new design.

TNB is committed to improving its environmental performance, with the objective of mitigating and reducing the negative impacts of utilizing coal on the environment. The concerns of the public have been taken into account in the decision making process and included in the preparation the Environmental Impact Assessment (EIA) studies and reports. Public acceptance surveys and socio-economic impact analysis have been conducted within the scope of the EIA regulations and requirements. (e.g. for the new 3x700 MW TNB Janamanjung project in Lumut, Perak)

Implementation of a clean fuel strategy based on greater utilization of coal will require involvement, consultation and acceptance from the general public, which includes government departments and statutory agencies, non-government organizations (NGOs) and the public and local communities. It is important that the public and the local community have a positive perception of the clean coal concept, strategy and the technologies which will help safeguard the environment. The traditional perception that coal is old fashioned and dirty needs to be managed to win public confidence in the positive attributes of coal other than it being the cheapest and most abundant source of fuel. Public awareness on clean coal needs to be enhanced through education, information, seminars and participation forums. Continuous review of their concerns over a particular project needs to be addressed and follow up actions taken to alleviate those concerns

In order to comply with more stringent local and global environment requirements, TNB has embarked on an Environmental Management System (EMS) based on ISO 14000. Most TNB stations have been ISO certified and the TNB coal fired plant at Kapar (SJSSAA), has been audited by SIRIM and, subject to clearing a few corrective actions, is on the way towards certification.

TNB has taken a lot of effort in the daily operation of the Station to ensure that any adverse perception of coal utilization as a source of pollution is dispelled. This is achieved by utilizing the current state of technology based on conventional clean coal technologies such as:

- Using export quality clean coals; low sulphur (less than 1.0%) and low ash contents are specified as the design coal for the plant.
- Installation of electrostatic precipitators which deliver 99.9% efficiency.
- Chimney height of 180 meters to ensure efficient dispersion of flue gas emissions.

- Ash handling ponds to handle the ash slurry from the P.F boilers.
- Enclosed coal handling system and provision of water spray facilities at the coal stock pile to mitigate dust problems.
- Fly ash handling system completely enclosed and ensures prompt disposal to a ready customer in cement production.
- Setting up air quality monitoring stations located in the various populated areas around the Station.

To minimize the potential pollution to the environment during plant operations, the boiler flue gas emission quality is continually monitored to enable continuous appraisal of air quality level and appropriate action taken promptly.

A Public Relations building and center was established at the Station to develop and maintain a close relationship with the local community. Meetings between the local community and the Station are held regularly so that issues and concerns from both parties are discussed and resolved.

5.2 Coal Procurement

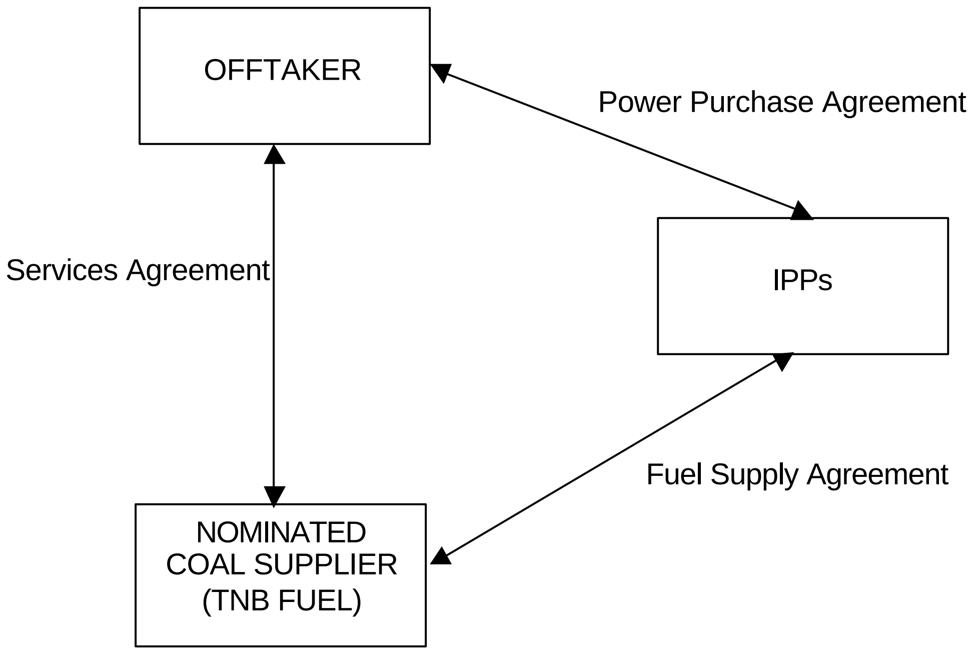
The major component of electricity generation cost is the cost of fuel. Presently coal is the cheapest fuel per unit generated. Apart from strategizing for the security of supply, purchasing coal at the minimum possible cost is very critical in reducing the generation cost. It is a great challenge to TNB Fuel Services Sdn. Bhd. (TNBF), a wholly owned subsidiary of TNB and the nominated coal supplier for TNB and the IPPs.

5.2.1 Role of TNB Fuel Services in Coal IPPS

TNBF started its business operation in September 1998, as the nominated coal supplier to TNB and to IPPs having Purchase Agreement (PPA) with TNB with a fuel pass-through cost component. Its main function is to manage and mitigate TNB's exposures to fuel risks. The concept of a nominated coal supplier to the IPP is stipulated in the PPA, where fuel cost is a pass-through component. In order to manage the coal pass-through cost, TNB as the Offtaker, has been given the right by the Malaysian Government to nominate a centralized coal supplier to supply coal to the IPPs. This decision is expected to reduce the ultimate cost of coal through economies of scale and avoidance of any other additional hidden cost. TNBF is therefore contractually bound to the Offtaker and the IPP to deliver the specified coal at optimal cost.

5.2.2 Tri-Party Contractual Arrangement

The relationship between TNBF, IPP and the Offtaker is best described as a Tri-Party Contractual Arrangement. In the Tri-Party Contractual Arrangement, TNBF provides a coal supply arrangement package that conforms to the IPP's technical requirements and also satisfies the IPP's lenders which includes the security and reliability of the whole coal supply chain package. TNBF's other roles include being the supplier of fuel oil and distillate for all TNB's power stations and management of TNB's gas supply contracts.



5.2.3 Managing the requirements of IPPS

In a non-recourse financing for IPPs, Lenders will normally require Project Developers to engage into long term coal supply contracts to cover at least the loan period for a major portion or percentage of the annual coal supply requirement. These stipulations by the Lenders do not allow the flexibility in coal sourcing in order to optimize the fuel or coal cost. The security of Lenders for debt servicing is being made at the expense of the Offtaker, which will have to bear with sub optimal coal procurement strategy, by the IPPs.

As a result of Lenders stipulation with regards to the long-term coal supply and shipping contracts, the coal producers and ship owners (coal transporters) will usually demand an annual minimum offtake level to be specified in their contracts. The IPPs will in turn be requesting for a minimum level of energy offtake from the Offtaker. An Offtaker will not want to be in a position where they are obliged by a minimum energy offtake from all coal fired IPPs.

Ideally, the IPPs have the liberty of designing the specification for its plant. However, it has to be noted that the NPV of the annual fuel cost over the PPA period will be higher than the CAPEX of the power plant. The Offtaker will have to bear the fuel pass through cost and it is to the Offtaker's interest that the coal design range must include the coal that is easily available and cheap. Domestic coal and Indonesian coal should be the natural supplier of coal to Malaysia as China for Japan based on geographical proximity.

Under the traditional arrangement, each IPP will be sourcing their own coal supply, shipping contracts and managing their own logistics for the whole coal supply chain from the mine right up to the power plant. All the inherent inefficiencies in the logistic management of the whole coal supply chain in each of the IPPs will be passed on to the Offtaker in the fuel pass through cost.

The Offtaker and IPPs can benefit from the economy of scale and integrated procurement management when the procurement of coal supply and shipping services are done through one centralized coal supplier for all IPPs rather than separately, as being done in the traditional IPP coal sourcing structure.

A single purchaser for all IPPs will also give flexibility in sourcing strategy and delivery scheduling as coal supply and shipping contracts need not have to be for specific power plant but rather a pool of IPPs power plant. The Offtaker also need not give any minimum energy offtake to the IPPs in the PPA, as coal supply contracts will be contracted to a group of IPPs power plant between the centralized coal supplier and the coal producers.

The nominated centralized coal supplier will not be dictated by Lenders stipulations on procurement strategy. The Lenders stipulations will have to be addressed separately by the Offtaker in the PPA without compromising on the IPPs project development. The centralized coal supplier can adopt a strategy that will ensure reliability, security and availability of supply at the minimum possible cost.

With integrated procurement, the Offtaker through the centralized coal supplier will emerge to be one of the largest single buyers of coal. This position will open up opportunities for the centralized coal supplier to enter into coal and coal chain related business and services

5.2.4 Coal Import

Virtually all coal that is required by Malaysia for the power sector is imported from the major coal exporting economies of Australia, Indonesia, China and South Africa. Malaysia has been importing about 60 % from Australia, 30 % from Indonesia, 5 % each from China and South Africa. Coal import from China to Malaysia has been going on for some time, however the tonnage has not increased. South Africa is a relatively new supplier to Malaysia. There is a need for TNBF to explore the potential of these two economies as suppliers to Malaysia. Coal is procured either through long-term contracts (5+5 yrs), medium term contracts (3+3 yrs) or spot purchases. For security of supply, long term and medium term contracts are normally signed with coal producers or international coal traders.

6.0 OPPORTUNITIES

6.1 Major Beneficiaries

As mentioned earlier in Table 3, coal utilization is expected to increase to 19.2 million tonnes per annum at a total delivered cost of about USD 760 million. This would definitely create opportunities in various fields for the existing and new entrepreneurs both local and international. The major beneficiaries will be mine owners and producers, coal traders and agents, and coal transporters.

On coal shipping the estimated revenue will be more than USD150 million per annum and would certainly benefit the local shipping industries as it is a government policy that priority be given to Malaysian ship owners and operators.

Opportunities will also be available for other groups who will benefit directly or indirectly for example port operators, insurers, coal laboratories, surveyors and trainers.

6.2 Ash Utilisation

Ash is major by- product of coal combustion. Presently in Malaysia it is being used by the cement industries only. Research has been done for other usage and there exist opportunities for various commercial applications including the following:

- Lightweight aggregates (both course and fine).
- Structural grade fills materials.
- Road construction.
- Cold molded bricks and related products (light weight or high strength)
- Kiln fired bricks
- Light weight thermal insulation materials
- Inert chemical fillers
- Binders for hazardous waste stabilization.
- Soil conditioning and soil stabilization.
- Horticultural uses.

As for the bottom ash the disposal presently at Kapar is to the ash pond through mixing and flushing with seawater causing it to be unusable due to the salt content. Future power stations should perhaps look at other alternatives that would enable the ash to be collected and used as the fly ash. One such alternative is the dry type disposal.

6.3 Prospect of Domestic Coal Supply

Coal resources in Malaysia are mainly found in Sarawak and Sabah. The resources are estimated to be about one billion tonne, most of which are low-grade lignite and sub-bituminous coal. These are likely to be only economical for use by mine mouth power plant. The coal deposits are largely unexplored and most information is from preliminary surveys conducted by the Geological Survey Department of Malaysia.

The major constraint is that the deposits are of low grade and located in the interior where infrastructure is lacking. Development cost of these deposits is estimated to be high. A large portion of these deposits is only amenable to costly underground mining. Economic development of these deposits is also facing stiff competition from other economies such as Indonesia, with bigger coal resource and a better-established coal industry.

The present coal production comes from Global Minerals Sdn Bhd (Pan Global Group) mine at Merit Pila Field. In 1999 it produced about 300,000 tonne most of which went to Sejingkat Power Plant (2 x 50 MW coal-fired) in Sarawak. Global Minerals also has an evergreen contract to supply 120ktpa to Kapar. Delivery has however been suspended over the last few years due to quality problems.

Meliau coal deposit in Sabah, with high quality bituminous coal, is the best prospect for development and supply to TNB. However, following the state government declaration of forest reserve area around the deposit, development has been suspended.

With the increase in coal demand locally perhaps it is more viable now to explore the local resources.

7.0 CONCLUSION

Presently the power sector fuel demand in Malaysia is over-dependent on gas. To supplement gas, coal has been identified as a viable additional and alternative fuel source for the future. Up to the year 2007, there will be three major coal fired power stations coming on stream with a total capacity of 5,600 MW and a combined coal consumption of about 15 mtpa. The total coal fired installed capacity in Peninsular Malaysia by then will be 7,200 MW with a total coal consumption of about 19 mtpa. By the year 2010 it is projected that the installed capacity in Peninsular Malaysia will increase to 27,000 MW from the present 12,000 MW and generation on coal will contribute about 33 % of the generation mix and gas generation will be reduced to 62 %.

The benefits from increased coal utilisation are set to encourage and provide opportunities for existing and new entrepreneurs, both local and foreign.

Controlled utilisation of coal will encourage safe, efficient and reliable use of coal, thus creating minimal impact to the environment.